

U.S. Patent Application Serial No. 09/884,998
Amendment dated December 31, 2003
Reply to OA of October 2, 2003

AMENDMENTS TO THE SPECIFICATION:

Please add the following paragraphs between lines 2 and 3 on page 27 of the specification.

A crawler belt bushing of this invention includes quench hardened layers formed so as to extend toward its wall core from its outer circumferential surface and from its inner circumferential surface respectively, and a soft layer formed between the quench hardened layers. The quench hardened layers and the soft layer are formed such that the quench hardened layer of the outer circumferential surface has a depth greater than the depth of the quench hardened layer of the inner circumferential surface, by: (a) increasing the cooling rate of the outer circumferential surface in order to reduce heat capacity at the core and by second cooling of the workpiece from its outer circumferential surface which is started a certain time after the first cooling and/or (b) increasing the cooling rate of the outer circumferential surface by first cooling of the workpiece from its inner circumferential surface in order to partially make the core unhardenable by utilizing the mass effect of the wall of the workpiece and by second cooling of the workpiece from its outer circumferential surface which is started a certain time after the first cooling. The soft layer has a core region and intermediate regions, one of the intermediate regions being between the core region and a respective one of the quench hardened layers, the core region being composed of one or more structures selected from the group consisting of ferrite, pearlite, bainite and martensite which are precipitated during cooling from the quenching temperature, the bushing being low temperature tempered.

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A crawler belt bushing of this invention includes a carbon 0.35 to 2.0 wt%, containing at least one of the alloying elements of Mn, Si, Cr, Mo and Ni, and made by a method in which a bushing workpiece made of steel, which is through hardened by simultaneous cooling from the outer and inner circumferential surfaces of the workpiece, is induction heated from the outer circumferential surface so as to raise at least the surface temperature of the inner circumferential surface to a quenching temperature, and thereafter. A series of quenching operations includes firstly cooling the workpiece from the inner circumferential surface; 1. heating the workpiece from the outer circumferential surface while cooling the workpiece from the inner circumferential surface; and 2. then, cooling the workpiece from the outer circumferential surface so as to form quench hardened layers which extend toward the wall core of the workpiece from the outer circumferential surface and from the inner circumferential surface respectively and form a soft layer between said quench hardened layers. The soft layer has a core region and intermediate regions, one of the intermediate regions being between the core region and a respective one of the quench hardened layers, the core region being composed of one or more structures selected from the group consisting of ferrite, pearlite, bainite and martensite which are precipitated during cooling from the quenching temperature and which contain or do not contain granular cementite dispersed therein.